



**A
R
M
S
T
R
O
N
G

L
A
B
O
R
A
T
O
R
Y**

**OUTLINE OF NEUROPSYCHIATRY IN
AVIATION MEDICINE II**

**Suzanne E. McGlohn
Raymond E. King
John C. Patterson**

**AEROSPACE MEDICINE DIRECTORATE
CLINICAL SCIENCES DIVISION
NEUROPSYCHIATRY BRANCH
2507 Kennedy Circle
Brooks Air Force Base, TX 78235-5117**

December 1995

Interim Technical Report for Period 1940 – 1995

Approved for public release; distribution is unlimited.

19960311 202

DTIC QUALITY INSPECTED 1

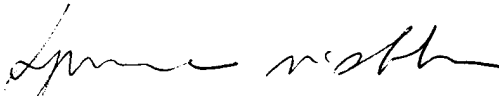
**AIR FORCE MATERIEL COMMAND
BROOKS AIR FORCE BASE, TEXAS**

NOTICES

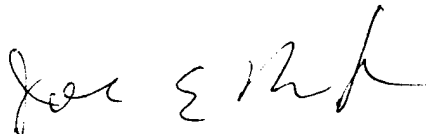
When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely Government-related procurement, the United States Government incurs no responsibility or any obligation whatsoever. The fact that the Government may have formulated or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication, or otherwise in any manner construed, as licensing the holder, or any other person or corporation; or as conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

The Office of Public Affairs has reviewed this technical report, and it is releasable to the National Technical Information Service, where it will be available to the general public, including foreign nationals.

This technical report has been reviewed and is approved for publication.



SUZANNE E. MCGLOHN, Major, USAF, BSC
Project Scientist



JOE EDWARD BURTON, Colonel, USAF, MC, CFS
Chief, Clinical Sciences Division

REPORT DOCUMENTATION PAGEForm Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE December 1995	3. REPORT TYPE AND DATES COVERED Interim- 1940 - 1995	
4. TITLE AND SUBTITLE Outline of Neuropsychiatry in Aviation Medicine II			5. FUNDING NUMBERS PE - 62202F PR - 7755 TA - R0 WU - 01	
6. AUTHOR(S) Suzanne E. McGlohn Raymond E. King John C. Patterson				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Armstrong Laboratory (AFMC) Aerospace Medicine Directorate Clinical Sciences Division, Neuropsychiatry Branch 2507 Kennedy Circle Brooks Air Force Base, TX 78235-5117			8. PERFORMING ORGANIZATION REPORT NUMBER AL/AO-TR-1995-0191	
9. SPONSORING/MONITORING AGENCY NAMES(S) AND ADDRESS(ES)			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) This manual discusses issues in psychiatry and psychology unique to aerospace medicine including: psychiatric disease in the aviator, selection of aircrew and astronauts, fear of flying, and the personality of the successful aviator. This manual addresses issues not emphasized in the typical psychiatry or psychology text, specifically airsickness, combat stress, aircrew fatigue management, prisoner-of-war experiences, and sequelae of aviation mishaps (accidents). Other issues in psychiatry and psychology, which are not fundamentally different from those encountered in everyday civilian and military practice, are not addressed in detail here but are dealt with in many widely available textbooks.				
14. SUBJECT TERMS Aerospace Medicine Psychiatry Psychology			15. NUMBER OF PAGES 40	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL	

We dedicate this review to David R. Jones M.D. for his efforts to combine mental health with aerospace medicine and to the unknown individuals who contributed to previous versions of this manuscript.

Contents

	Page
Dedication.....	iii
Section 1 General.....	1
Section 2 Cognitive Disorders.....	3
Section 3 Substance-Related Disorders.....	5
Section 4 Psychotic Disorders.....	7
Section 5 Mood Disorders.....	10
Section 6 Anxiety Disorders.....	12
Section 7 Sleep Disorders.....	14
Section 8 Adjustment Disorders.....	17
Section 9 Personality Disorders.....	19
Section 10 V Codes.....	22
References.....	27

Section 1

General

This manual discusses issues in psychiatry and psychology unique to aerospace medicine including: psychiatric disease in the aviator, selection of aircrew and astronauts, fear of flying, and the personality of the successful aviator. This manual addresses issues not emphasized in the typical psychiatry or psychology text, specifically airsickness, combat stress, aircrew fatigue management, prisoner-of-war experiences, and sequelae of aviation mishaps (accidents). Other issues in psychiatry and psychology, which are not fundamentally different from those encountered in everyday civilian and military practice, are not addressed in detail here but are dealt with in many widely available textbooks. For example, all current diagnoses are formulated and recorded according to observable and measurable definitions, avoiding any theoretical model in the *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV; 16)*. Psychiatric interview techniques are discussed in most basic texts, such as the volume by McKinnon and Michels (47). Emergency psychiatry, including diagnosis and treatment, is covered in multiple guides and handbooks including Hyman's text (30). Several overall summaries, reference books, and student introductory texts are widely available, such as Kaplan and Sadock's *Comprehensive Textbook of Psychiatry* (37), and a volume by Talbott (62). Kaplan and Sadock discuss military psychiatry, but not specifically aviation, in chapter 44 (37). An earlier tome by Kaplan, Freedman and Sadock (36) has both a military chapter (No. 46.1) and an aerospace chapter (No. 46.2) in volume 3.

A pertinent synopsis of aerospace psychiatry, psychology, and neurology including remarks about therapy/disposition, underlying philosophy, and a discussion of specific aeromedical topics, is found in chapter 17 of *Fundamentals of Aerospace Medicine* (14) and printed proceedings of a NATO-AGARD Symposium (54). Much more dated, but fundamentally sound, information is contained in chapters by Randel (57) and Dhenin (15). The US Naval Flight Surgeon's Manual covers psychiatry at some length with particular attention to prisoner-of-war and repatriation experiences (67). This manual follows the spirit of the original War Department Technical Manual, *Outline of Neuropsychiatry in Aviation Medicine* (TM-325), published in 1940.(69)

In addition to assistance through references cited at the end of this manual, formal consultation or informal discussion is available with your base psychiatrist and/or psychologist, a number of whom have aviation expertise. When a base-level psychiatrist or psychologist does not have aviation expertise, the flight surgeon may consult the base mental health office with specific questions such as: "Is this individual's depression resolved such that he or she is able to resume flying duties pursuant to regulations?" (1). Another approach might be: "Please

comment specifically upon suicide risk, both present and future.", rather than: "Please evaluate." Similarly, the Neuropsychiatry Branch of the Aeromedical Consultation Service, Brooks AFB, Texas is available telephonically at DSN 240-3537 or via e-mail McGlohn@alaoc.brooks.af.mil (as of Jan 1996), during duty hours for consultation and advice regarding therapy and aeromedical disposition. Whichever route of consultation the flight surgeon chooses, the provider should not hesitate to obtain a specialist's advice in this field where superficial appearances are often deceiving, due to the potentially significant occupational consequences and typical aviator emotional defenses. Due to aviators' tendency toward denial and minimization, as will be discussed, their mental health is particularly difficult to evaluate.

Evaluation of aviators is difficult partly because aviators often see aeromedical specialists as adversaries. Evaluation of aviators is also difficult due to the unique and necessary occupational and aeromedical perspective. Clinical evaluation, diagnosis, and intervention are important in aerospace medicine, but are often secondary to performance enhancement, health promotion, prevention, and the important role of detection. Thus, while most health providers have the training and experience in clinical skills, aerospace medicine requires a broader, occupational approach. This need is easily seen in the psychiatric and psychological evaluation of aviators. The DSM-IV (16) is a nomenclature for the typical, self-reporting, or at least poorly defended, patient. The criteria help the clinician differentiate between categories of disorders and then on to specific diagnoses. Often the aviator does not appear to meet DSM-IV criteria for any diagnosis, but may be distressed enough to preclude safe flight.

Despite the difficulties inherent in the psychiatric evaluation of this population, a seven-year retrospective review of psychiatric hospitalizations in aviators and their subsequent rates of return to flying status conducted for 1986 to 1992 revealed mostly positive outcomes. From a population of over 35,000 USAF rated aviation officers on flying status, 214 were psychiatrically hospitalized. The study found that 66% of the psychiatrically hospitalized aviators were returned to flying status over the seven-year study period. This finding is very encouraging for a group who fear contact with mental health professionals (20).

A 10-year review (1980-1989) of the incidence of psychiatric disease in aviators referred to the ACS of the Armstrong Laboratory at Brooks Air Force Base, prepared by Patterson, Sipes, and Marsh and presented at the 1993 meeting of the Aerospace Medicine Association. It was found that most aviators were referred for psychological aspects of medical complaints (35%), followed by anxiety (18%), depression (14%), acute adjustment problems (13%) and marital discord (11%). Most (77%) were recommended for return to flying status and the vast majority of the others (21%) were recommended for return to flying after treatment. The remaining 2%, consisting of somatization, depression, and alcohol treatment failures, were recommended for permanent disqualification. The study concluded that early evaluation and treatment result in the best outcome and earliest return to flying. Thus, the assumption by some aviators and aeromedical consultants that a referral to mental health is a career "kiss of death" is unwarranted. It may be important to bear in mind, however, that the Patterson, Sipes, and Marsh study

included only those aviators referred to the ACS for consideration of waiver of aeromedical standards (1), and hence does not include all aviators requesting a waiver.

Section 2

Cognitive Disorders

Cognitive disorders include the deliriums, dementias, amnesic disorders, and other disorders due to general medical conditions. These disorders are generally quite uncommon in the aviator population. Only three cases of Organic Brain Syndrome were diagnosed in a population of 254 psychiatrically hospitalized aviators between 1986 and 1990, representing only 1.4% of hospitalized aviators (20). Delirium is a disturbance of consciousness with reduced ability to focus, sustain, or shift attention, with a change in cognition. The disturbance usually develops over a short period of time. A medical condition generally underlies delirium (16). These cases usually represent medical emergencies, and become retrospectively important to the flight surgeon when the aviator seeks a return to flying duties.

Dementia involves the development of multiple cognitive deficits manifested by memory impairment and other cognitive disturbances. The most common cause of dementia in the general population, Alzheimer's Disease, has a very low incidence in the aviator population. Mild cognitive deficit following head injury is of greater interest. Aviators are at greater risk for head injury secondary to risks inherent in their occupation and their tendency for thrill-seeking behaviors.

The risk of neuropsychological compromise was one of the motivations for the development of the Neuropsychiatrically Enhanced Flight Screening (N-EFS) program currently underway at Brooks AFB and the United States Air Force Academy. The first objective of N-EFS is to obtain individual baseline intelligence and cognitive functioning information for future comparison purposes in the event of a need for medical waiver consideration. CogScreen-Aeromedical Edition (CogScreen-AE; 40) and the Multidimensional Aptitude Battery (MAB) are administered to candidates for undergraduate pilot training (UPT), for potential comparison purposes in case future neuropsychological evaluation is clinically indicated (1). The need for baseline assessment of aviators, who are at high risk for traumatic brain injury, has long been recognized as urgent. Traditional neuropsychological assessment is time consuming, and can be subject to examiner inexperience and administrator error. Military health care providers may note pilots presenting themselves for evaluation and treatment who have documented IQ and CogScreen results in their medical record indicating they have completed the MAB and the CogScreen-AE as a result of routine N-EFS screening.

N-EFS also seeks permission to obtain psychological testing data and compare the results to actual performance of mission tested pilots to determine if these instruments can serve a predictive function. Adequate selection and placement of pilots may reduce training costs and improve flight safety(15, 14 [chap. 13]). Studies on who become successful USAF aviators have been done for years, showing modest scientific validity, but dismal administrative acceptance. Attitudes may be changing due to economic necessity. Voluntary participants, at the commencement of pilot screening, complete the commercially published Revised NEO Personality Inventory (NEO-PI-R), a gauge of normal personality functioning and the Personal Characteristics Inventory (PCI), which was developed to measure judgment and the potential for effective crew resource management. Participants are advised that follow-up will occur two years into their particular airframe assignment, to correlate their testing data with their eventual performance. Other programs, such as the Air National Guard Top Performer program (21), Air Force Special Operations Command's Commando Look, and National Aeronautics and Space Administration astronaut selection are examples of current efforts in aviator selection.

Previous selection studies typically attempted to use completion of training as the criterion of success, rather than actual mission readiness or performance in the assigned aircraft. Such short-term research is frequently plagued by the "honey-moon effect" (29). Many participants, attempting to look their very best, can sustain high levels of performance, but only in the short-run. Human factors have been recognized as a major contributor to Undergraduate Pilot Training attrition and the major cause of aircraft mishaps, and hence, represent a critical source of lost lives and flying aviators. resources. While previous studies have attempted to discern who *can* finish pilot training, scant information exists on who *will* finish pilot training and evolve into effective military aviators.

Pilot selection historically rested on four areas: a. cognitive and psychomotor tests, b. the physical examination; c. assessment of mental health and d. motivation. The flight surgeon performs most aspects of the evaluation, while other aspects are completed by other investigators, and remain unknown to the flight surgeon. Studies have shown that of 1,000 flight applicants, 500 were rejected for physical disorders and another 250 for psychological conditions; 100 had training failures, and consequently 150 graduated (57 [chap. 25]).

From 1942 through 1955, psychomotor testing of candidates was performed utilizing electromechanical apparatus. This practice was discontinued in 1955 due to difficulty in calibrating the machinery and problems with reliability between different examining stations (7). The replacement was a paper-and-pencil test, the Air Force Officer Qualification Test (AFOQT) (57 [chap. 24], 14 [chap.13]). A computer-based test battery was subsequently devised that attempted to reproduce the early psychomotor testing, but without the quality control problems (11). The physical examination is specialized for aviation with the specific parameters delineated in the physical standards regulation (1).

Assessment of the mental health and motivation of the candidate are more ambiguous than assessment of physical status. In response to the great losses early in World War I, 90% of which were due to other than enemy action or mechanical failure, efforts to develop physical and mental standards of fitness rushed forward with positive results (57 [chap. 25], 14 [chap. 13]). Longacre developed the Adaptability Rating for Military Aeronautics (ARMA) (48, 57 [chap. 25]) in 1930. While recommendations to improve the ARMA have been made, they have not been instituted. A survey published in 1993 (68) outlined the current usage of the ARMA by flight surgeons. The investigators found that more flight surgeons were dissatisfied with the ARMA than were satisfied.

Areas important to a thorough ARMA include questions related to motivation to fly, such as whether the candidate has previously flown and how they found that experience. If the individual hasn't flown, he or she is asked about what they think it will be like. The candidate is asked about airsickness and the dangers of flying. The candidate is asked specifically about their motivation to fly and when their interest first started. They are queried about how their parents and significant others feel about their flying and what will happen if they are not admitted to flight training. The flight surgeon inquires about the handling of perceived stress, socialization, and achievements. Athletic activities, disciplinary problems, drug or alcohol use, fights, and anger management are discussed (14 [chap. 17], 57, 48). Overall, there is no objective standard for reaching a conclusion, but in the absence of any grossly detectable psychopathology or deficient motivation, the ARMA is marked satisfactory. In 1992, only three applicants were eliminated on the basis of an unsatisfactory ARMA, thus this tool is infrequently used by flight surgeons to eliminate an applicant (38). Despite dissatisfaction with the ARMA and obvious weaknesses of inter-rater reliability and questions about its validity, most flying organizations give at least lip service to the ARMA. The United States Army and Navy conduct the ARMA at the time of selection and at needed intervals in the aviator's career; the Air Force, however, generally conducts the ARMA only at the initial evaluation for aviation training. Some Air Force flight surgeons, however, staunchly maintain their prerogative to administer the ARMA as they see fit, regardless of the phase of the aviator's career.

Section 3

Substance-Related Disorders

Substance-Related Disorders are divided into two groups: Substance Use Disorders and Substance-Induced Disorders. Substance Use Disorders, including Alcohol Abuse and Alcohol Dependence, are more important than Substance-Induced Disorders in the aviator population. Alcohol Abuse is defined as a maladaptive pattern of alcohol use leading to clinically significant

impairment or distress as manifested by *one or more* of the following symptoms (occurring over a 12 month period):

- Recurrent use resulting in failure to fulfill a major role
- Recurrent use in hazardous situations
- Recurrent alcohol use-related legal problems
- Continued use despite social or interpersonal problems secondary to the use

Alcohol Dependence, on the other hand, is defined as a maladaptive pattern of alcohol use leading to significant impairment, as manifested by *at least three* of the following symptoms (occurring over a 12 month period):

- Tolerance to alcohol's effects
- Withdrawal symptoms upon cessation of alcohol intake
- Larger amounts consumed than was intended
- Unsuccessful efforts to cut down alcohol consumption
- A great deal of time spent ingesting or obtaining alcohol
- Activities given up due to alcohol
- Continued use despite severe problems due to alcohol (16).

A seven-year retrospective review of psychiatric hospitalizations of aviators (20) revealed that from a population of 214 psychiatrically hospitalized aviators, the largest percentage (56.5%) of the psychiatric inpatient stays were secondary to alcohol use disorders. This finding suggests that alcoholism is a mental health concern in this population. Returning to flying status, however, was not precluded by alcohol treatment, as 70.2% of these aircrew members returned to fly (20). However, in another population (54), alcohol was one of the few psychiatric diagnoses that occasionally resulted in permanent disqualification--usually after relapse.

A study (22) looking specifically at aviator alcoholism addressed the treatment of alcoholism in a population of airline pilots. The authors found that early identification and treatment of the substance-abusing aviator can be enhanced by encouraging teamwork between pilots, the union, management, and flight surgeons. In the program analyzed, 87% of the treated alcoholic pilots returned to flight duties and the rate of relapse was only 13%. Job-based, peer-oriented alcohol treatment was not only successful, but contributed to pilot retention. Thus, prevention and early treatment of alcoholism in this population can significantly conserve flying resources.

Section 4

Psychotic Disorders

Schizophrenia and other Psychotic Disorders are very uncommon in the aviator population, most likely due to the natural history of schizophrenia. Most cases of schizophrenia begin during the patient's early twenty's and pilot selection occurs later. The characteristic symptoms of schizophrenia include:

- Delusions
- Hallucinations
- Disorganized speech
- Disorganized behavior
- Negative symptoms, such as apathy and withdrawal.

Other psychotic disorders include:

- Schizoaffective Disorder
- Delusional Disorder
- Brief Psychotic Disorder
- Shared Psychotic Disorder
- Psychotic Disorders due to substances or general medical conditions.

In the seven-year retrospective review of aviator hospitalizations (20), we found eight aviator patients of 214 (3.7%) were admitted for a psychotic disorder. Within the group of aviators who did not return to fly, there were more cases of psychosis. Permanent grounding for psychosis in many cases makes sense, as the likelihood of permanent recovery is less certain than for other psychiatric disorders. In the previously cited 10-year ACS study, very few aviators with psychosis were seen but most returned to fly after 1-2 years of grounding and careful follow-up. Most of these cases were given the diagnosis of "Brief Psychotic Disorder" and often were related to a specific cause such as unintentional overdose of over-the-counter-preparations. The psychotic disorder for which aviators may be at greater risk is Brief Psychotic Disorder. This disorder presents with symptoms similar to those of schizophrenia but is of a short duration and may be precipitated by a markedly stressful situation. The stress of combat can precipitate a psychosis and "combat fatigue" can present in this fashion.

While inferences can be drawn as to the meaning of "nostalgia" diagnosed in the American Civil War, the clear differentiation of combat fatigue as an entity occurred in World War I, according to David R. Jones, retired USAF flight surgeon and psychiatrist. It was originally titled "shell shock," owing to the belief that it was caused by the concussion of artillery shells. The organic contributions to combat fatigue are now known to be fatigue, thirst, wounds, sub-optimal nutrition, sleep deprivation, and sleep-cycle interference, according to Marlowe at the Walter Reed Army Institute of Research(33).

What was learned regarding combat fatigue in World War I was largely forgotten between the wars and essentially rediscovered in World War II. This knowledge was carried forward into the Korean police action and was confirmed, but again principally in relation to ground troops (25). Due to the vast expansion of air power and aviation personnel, more attention was focused upon combat fatigue in the air-war setting and information was published following the Vietnam War (32, 33).

Although there was a high level of consciousness regarding combat fatigue in both the air and ground settings in the Southeast Asian War, the ground war experience was exhaustively documented (60, 34). Essentially nothing was recorded concerning the experiences of USAF aircrew, whether on a case report or epidemiological basis (32). A thorough, but unpublished, review of the Aerospace Medicine Reports from the involved air bases during the war by Dr. Ryder, at the United States Army School of Aviation Medicine in 1988 attempted to fill this gap, but did not find adequate information to document even a single case of combat fatigue.

Regarding future conflicts, the USAF has realized that aircrew will likely not be the only members at risk, as air bases will be vulnerable to aerial and ground attack by the enemy (33). Accordingly, it behooves flight surgeons to have basic knowledge of combat fatigue. It is well to remember that overall one out of five casualties had a neuropsychiatric diagnosis in World War II (37).

Marlowe (33) defines combat fatigue as a psychiatric syndrome of functional etiology with varying manifestations and degrees of severity, acute onset, and occurring in the combat setting. Often the clinical picture is fluid rather than fixed over time. Patients may present themselves with the appearance of apathy, withdrawal, and even psychomotor retardation resembling catatonia. At the opposite extreme is the out-of-control patient with hyperactivity who can be indiscriminately violent until controlled. Again, the person appears to be psychotic, depressed, or anxious. Finally, the faces of combat fatigue include apparent conversion reactions (e.g., blindness, paralysis, or amnesia) and psychosomatic reactions (e.g., headaches or diarrhea). Circumspection must be used with the latter, as premature evacuation may be recommended, which is opposite to the optimal treatment. Although we appreciated that some patients presenting themselves with acute psychiatric symptoms during combat will have a psychosis or another condition requiring evacuation to a higher echelon of care, as a rule it is wiser to begin with the initial impression of combat fatigue and proceed accordingly.

The most useful treatment approach for combat fatigue is represented by the acronym "BICEPS", (33).

1. **Brevity** - treat for 24-72 hours, with the explicit goal of return to duty upon completion of treatment.
2. **Immediacy** - treat as soon as behavior reveals an individual is unproductive, without awaiting a total collapse of function or personality.

3. Centrality - treat combat fatigue patients in a single location, not intermingled with other patients. Any who are violent or disruptive to others must be controlled and housed separately.

4. Expectancy - the conscious attitude and goal of the staff that each patient will recover and return to duty.

5. Proximity to the unit is the key to treatment in two respects:

a. Evacuation to the rear has been proven since World War I to significantly reduce recovery and to promote further regression and fixation of symptoms for years, if not life (60); and

b. When the soldier is close to his unit, he can maintain ties with it, and thus keep his principal support in combat, his group identity. It is even better if unit members or leaders visit the patient, reminding him of his place in the unit and its acceptance of the person despite suffering this illness.

6. Simplicity is treatment in the present (not uncovering or long-term therapy) which is completed within the 24-72 hours' time frame.

Treatment rests on two axes; supportive, restorative therapy and medications. The predominant thrust of the literature is toward supportive, restorative therapy. This effort may consist of opportunities for food, rest, sleep, emotional ventilation, and acceptance of the patient by his treaters and unit members. A positive attitude towards the patient and his future by the staff and unit visitors can go a long way with a night's rest (25). Treatment with medications can include the use of a hypnotic, such as temazepam at 15-30 milligrams, if indicated, for any sleep difficulty. An antipsychotic such as haloperidol at 10mg or chlorpromazine at 100mg is appropriate in cases of psychosis, violence, or uncontrolled hyperactivity. An anxiolytic such as diazepam 5-10mg or lorazepam 1-2mg can be used for marked anxiety and tremor (33, 25, 60). The Israelis' report that clean clothing to replace any clothing stained with blood is helpful, (Personal Communication).

The above addresses the treatment of combat fatigue after it has developed. Preventive treatment means reducing the individual's susceptibility to combat fatigue. This is done by educating commanders and all members that:

a. Group cohesion is the greatest support of all for individuals in combat .
b. Every person exposed to the stress of combat is at risk.
c. Development of actual combat fatigue does not relate to personal psychological limitations because the cause of combat fatigue is the stress of combat (57[chap 23]), especially its intensity and duration.

d. Everyone has a "breaking point" at which one no longer tolerates the stress and cannot function effectively.

e. It is normal to experience fear in combat, and also grief for lost friends.

f. These emotions are often accompanied by the somatic expressions of anxiety and depression.

Experience has shown repeatedly that units with better training and leadership suffer much less combat fatigue (37). Finally, commanders are advised that they can reduce their unit's susceptibility to combat fatigue by doing whatever is possible to normalize sleeping and eating

schedules, regularizing flying schedules (as opposed to constantly changing "shifts"), and by promoting an effective preventive medicine program.

More recent information on combat fatigue comes from experience gained during Operation Desert Storm. A study published in Hospital and Community Psychiatry (45) reports the results of the treatment of 158 Army combat stress casualties in a non-hospital based care delivery system. Simple interventions were used in this setting to briefly treat the soldiers, of whom 72 % were men. Ninety-nine percent of the treated soldiers were returned to duty, demonstrating the efficacy of the BICEPS model.

Section 5

Mood Disorders

Mood disorders constitute a major reason for loss of aviators. Between 1980 and 1989, 14% of ACS psychiatric referrals were due primarily to depression, while 7.4% of all psychiatric inpatient admissions of aviators from 1986-1990 were secondary to affective disorders. The rate of return to fly for these patients was less than other disorders. Nonetheless, affective disorders, especially depression, may be averted by early diagnosis and appropriate treatment. Seventy percent of depressed aviator outpatients evaluated at the ACS from 1991 to 1994 were recommended for return to flying status (20). Of 283 pilots evaluated at ACS from 1980 to 1989, 14% were diagnosed with depression and most (80%) were recommended to return to fly, while 17% were recommended for treatment before returning to flying status and 3% were recommended for permanent medical disqualification from flying.

The mood disorders are divided into depressive disorders, bipolar disorders, and other mood disorders. Depressive disorders, as noted above, tend to occur with greater frequency in the aviator population than other mood disorders. A Major Depressive Disorder can be single episode or recurrent, and is characterized by *at least five* of the following symptoms for a two week period:

- Depressed mood or loss of interest or pleasure most importantly
- Weight loss or loss of appetite
- Insomnia or hypersomnia
- Agitation or retardation of motor behavior
- Fatigue
- Feelings of worthlessness or guilt
- Diminished ability to think or concentrate
- Recurrent thoughts of death.

A Dysthymic Disorder is a milder form of depression but usually lasts longer (16).

Occasionally, acute depression can result from an aviation mishap or disaster. The usual duties of the flight surgeon in an aircraft mishap investigation are spelled out in Air Force safety regulations and in the Flight Surgeon's Guide. However, the humanistic aspects of dealing with the

survivors, the squadron mates of the deceased, and the families of all of these people must be considered. These considerations may also apply to near-misses or dramatic in-flight emergencies within the squadron and to terrorist actions involving the base or its deployed personnel.

On an individual level, persons who have just survived a life-threatening experience are typically emotionally shaken and likely to experience feelings of disbelief or "emotional numbing" (13). This feeling state may resolve spontaneously or with assistance, or may progress into a depression. The latter is more likely to occur if there is additional "survivor's guilt." Survivors normally suffer what is termed acute bereavement or critical incident stress (27), with the usual symptoms of preoccupation with the loss. These include difficulty concentrating, intrusive thoughts of the loss, feelings of emptiness, shortened attention span, difficulties making decisions, disturbed sleep, and assorted somatic discomforts. Among their concerns, especially for aircrew whose defenses usually consist of avoiding or compartmentalizing feelings, is the question of whether such feelings are normal. Since aircrew often avoid their feelings, they may have difficulties due to unresolved feelings, as illustrated in the case of a weapon systems operator (WSO) who developed fear of flying after a mishap (31).

In these cases, the flight surgeon may be very helpful on the individual level by encouraging ventilation, by accepting the person's feelings, by letting him know that his feelings are normal, and by educating him that sleep disturbance and other symptoms are common accompaniments of grief. The aviator should also know that grief reactions are self-limited. The strength of the flight surgeon's authority reassures the person, and a positive suggestion is made that the person will recover, just as in general supportive therapy (33). While the person may seek out the flight surgeon to discuss these feelings, the real point here is that the flight surgeon needs to take the initiative to formally or informally assist the person, just as the flight surgeon practices preventive care for physical problems.

The same feeling-state that affects individuals operates on the group after loss, causing inefficiency in the unit or disruption of the military mission, if it is not dealt with (6, 9). A series of feeling-states occurs before resolution of grief and return to normal functioning. These feeling-states can last as long as six months, even with intense intervention and enlightened, vigorous, command intervention (6).

While obviously a full-scale psychiatric response is beyond the scope of the flight surgeon, support of mental health intervention can be invaluable, due to the flight surgeon's relationships with commanders and the flying unit. The flight surgeon can facilitate treatment and is in the best position to note whether some subgroup (e.g., the maintenance section that worked on the aircraft just before the crash) is being overlooked. The flight surgeon can also facilitate acceptance of psychiatric services and command interventions by the served population and further encourage them to deal with their feelings, rather than moving off base or otherwise "getting lost" to care.

In a presentation to the American Psychological Association in 1987, Bartone explained that the US Navy has a mobile psychiatric assistance team, which goes to any base where a disaster or terrorist attack has occurred. The US Army is developing such a team and the USAF is considering developing such a team. The possibility of joint service or inter-service assistance is growing. Services provided by the mobile assistance team include advice to commanders and assistance to the base leadership throughout the period of chaos and numbing. These services include reminding leaders of steps they can take to decrease psychiatric morbidity and to maintain mission readiness. These steps include: assuring proper sleep, encouraging avoidance of alcohol, reinforcing unit cohesion, mobilizing base and community supports, attending to one's own psychological needs, and ensuring adequate rest for everyone. Being aware of the existence of such teams, the flight surgeon can advise the commander in their use during a time of need. In mishaps or small scale disasters not requiring external assistance to the base, the flight surgeon can still encourage command to make use of these same principles for the benefit of all.

Section 6

Anxiety Disorders

Anxiety Disorders include Panic Disorder, Phobias, Obsessive-Compulsive Disorder, Generalized Anxiety Disorder, and most importantly Post-Traumatic Stress Disorder and Acute Stress Disorder. The incidence of anxiety disorders in general was 2.8% in the review of hospitalized aviators done for 1986-1990 (20) and 18% in the ACS 10-year study for 1980-1989. Post-Traumatic Stress Disorder or PTSD occurs when the person has been exposed to a traumatic event in which there was threat of injury to self or others and the person's response involved intense fear, helplessness, or horror. The traumatic event is then persistently reexperienced in intrusive recollections, dreams, flashbacks, psychological distress, or physiological reactivity. There is a persistent avoidance of stimuli associated with the trauma and persistent symptoms of arousal. The disturbance causes clinically significant impairment for more than one month. Acute Stress Disorder is characterized by exposure to a traumatic event similar to that seen in PTSD, but the experience is marked by dissociative symptoms in addition to the recollections, avoidance, and distress seen in PTSD. Additionally, the symptoms of Acute Distress Disorder last no longer than four weeks (16).

Aviators are at increased risk for these disorders (particularly PTSD) when exposed to combat, survival, or prisoner-of-war situations. The flight surgeon may be very helpful to his or her assigned aircrew by giving group briefings prior to entering, or while in, combat concerning mental preparation for survival or POW situations. With the wide-spread use of electronic locator

transmitters in peacetime, the likelihood of extended survival prior to rescue in hostile terrain and climate is generally low, but for those frequently flying over such terrain, mental preparation for survival is in order.

Prior to entering combat, it is wise to prepare the family as much as possible in both legal and emotional issues. Recommending the advice of a lawyer for wills and powers of attorney can be helpful to family members. Emotionally, families should be aware of possible role shifts which can occur during the sponsor's absence and the resources available to them through the mental health clinic or family services.

The Navy has conducted studies on emotional response to combat and survival (67). In the combat or survival situation, they report that the first emotional response to combat or survival is generally that of disbelief. This results from the sudden shock of a change from feeling in control of one's life, so important to the aviator's normal emotional balance, to being entirely out of control. In addition there is the shock of suddenly being in an alien culture or environment. This period lasts from six weeks to six months, during which many of the symptoms seen in a typical depression can occur, including: difficulty concentrating, sleeping, making decisions, and performing complex tasks. Some POW's who were repatriated during this phase continued to exhibit these symptoms after return to safety. This phase ends, sometimes quite abruptly, with the firm decision to cope with the situation and get along with life under the new conditions.

The next phase is the actual coping with the circumstances. Here, it appears that developing a certain detachment or apathy is a healthy defense. Conversely, those with excessive dependency or rigidity may unwittingly bring more abuse upon themselves and otherwise cope poorly. In other words, those who are more neutral may fare much better in terms of handling the stresses than those who are either extreme resisters or collaborators.

Particularly in the Vietnam experience, POWs were astonished that they broke under torture; sometimes quickly. This rapid break under torture induced guilt and self-doubts. When they were able to communicate with other prisoners and found their experiences were similar, their guilt was alleviated. In this context, mental preparation plus flexible application of the Code of Conduct will be useful supports.

Further phases of adjustment occur at the time of repatriation, and later, during readaptation to life back home. These phases also have their dangers. Overall, the greatest support to the individual throughout these phases is group identification (67). In the capture and captivity phases, this identification is with one's country and fellow captives. Thus, organizing communications and a leadership hierarchy is extremely important. On repatriation, the group reverts to its usual family, work, and social support systems.

For those in solitary confinement, keeping mentally active is extremely important. Learning the language of the captor and performing a sort of private psychoanalysis through review of one's life

are examples of mental exercise. One man spent his time in captivity founding a lumber yard, moving his stock about, selling stock, and expanding his business to form a chain of stores in nearby cities. Upon release, he headed quite an "empire."

In the case of communist captors, it can be expected that there will be efforts at indoctrination with communist ideology. There is no evidence that such efforts actually persuaded any Americans not already rootless or disaffected to espouse communism (67). Nor was there any magical "brainwashing" of prisoners to abandon their moral values.

Concerning the development of psychopathology during captivity or following repatriation, the evidence shows mental deterioration is related to the degree of stress inflicted and its duration. There has been no demonstrable relationship between psychiatric predisposition existing before capture and pathology after repatriation (64).

Finally, with the exception of those POWs who developed overt psychopathology, such as PTSD, there was an undetermined percentage who felt that they had undergone personal growth as a result of the experience (64). This perspective may be worth bringing to the attention of aircrew.

In her autobiography, Rhonda Cornum, an Army Flight Surgeon and prisoner of war in Iraq, comments: "Being a prisoner of war is the ultimate loss of control, especially for a POW with two broken arms. What I learned in those Iraqi bunkers and prison cells is that the experience doesn't have to be devastating, that it depends on you. You can give up control of your mind, but no one can take it away from you. I convinced myself that as long as my brain was working, I would be fine." She states that the entire experience of the war was a challenge that would be tough to match (12).

Section 7

Sleep Disorders

Sleep Disorders are normally divided into dyssomnias and parasomnias. Insomnia and Circadian Rhythm Sleep Disorder are the most common complaints of sleep difficulty in the aviator population. Insomnia is defined as nonrestorative sleep, or difficulty initiating or maintaining sleep for at least one month's duration. The sleep disturbance causes significant distress and does not occur exclusively during the course of another disorder. Circadian Rhythm Sleep Disorder is a persistent or recurrent pattern of sleep disruption leading to excessive sleepiness or insomnia that is due to a mismatch between the sleep-wake schedule required by the person's environment and his or her circadian sleep-wake pattern. Other dyssomnias are less common, such as Primary Hypersomnia, Narcolepsy, and Breathing-Related Sleep Disorder. The

parasomnias; Nightmare Disorder, Sleep Terror Disorder, and Sleepwalking Disorder, all begin in childhood (16) and are disqualifying for Flying Class I duties, thus a pilot candidate is disqualified from flying training(1).

Wiley Post, the first person to fly around the world (in 1931), discussed problems which we now identify as due to the disturbance of circadian rhythm (23). Although biological rhythms had already been the subject of scientific inquiry for 200 years (28), Post's observation represented their first consideration in relation to aviation. The term "circadian" originates from the Latin word "circa" meaning about and "dies" meaning a day and serves as a good reminder that this bodily cycle is timed to the rotation of the earth upon its axis (57 [chap. 4]). Events which help synchronize the person's rhythm with the environment such as meals, normal work schedules, hours of light and darkness, and so forth are referred to as synchronizers, cues, entraining agents, and zeitgebers (52). Desynchrony or desynchronization refers to that state in which the person's circadian rhythm is inconsistent with the local environment's cues. "Circadian rhythm" refers to a collection of bodily rhythms (temperature, sleep, wakefulness, physical activity, memory performance, electrolyte excretion, cortisol, and other hormone levels, among others) rather than any particular one (28, 66). Actually, it turns out that human circadian cycles range from 24 to 27 hours in length, averaging 25 hours (15 [chap. 23], 28).

The body can normally adjust to a shift in the environment of 60-90 minutes per day, as in travel by boat (23). Desynchrony is caused by traveling too rapidly to permit immediate adjustment to the new environment's zeitgebers, usually by crossing four or more time zones (23, 46), hence, the popular term "jet-lag." Resynchronization on the new schedule is hampered and symptoms are increased by the several bodily hormonal systems shifting phase at different rates of speed from each other (28). Recovery from desynchrony was formerly thought to occur at the rate of 1 hour per day (57 [chap. 4]), but it is now considered to occur on a non-linear basis. Thus, the out-of-phase condition is halved every 48 hours or exponentially (28).

People vary in their susceptibility to desynchrony. It was once thought that there was a difference by sex, but more recently these reports have been found inconsistent (23). There is agreement that over time older persons, to include aircrew over age 40, who are already subject to reduced strength of circadian control, have more difficulty with desynchrony than young adults (15 [chap. 23], 23, 46). All persons are found to be more affected by travel from west to east than vice versa (14 [chap. 13], 27). A good way to remember this rule is: "West is best." Alcohol as well as hypoxia are exacerbating factors (46) in desynchrony.

The symptoms produced by desynchrony are multiple. There is a generalized discomfort and sense of fatigue, a lowered physical activity level, reduced efficiency, and impaired judgment or decision-making (14 [chap. 13], 46). Desynchrony has been suspected as contributing to various aircraft mishaps and the Three Mile Island nuclear plant accident (28). Desynchrony is of great concern to military flight surgeons because operational requirements often dictate that aviators be

ready for flight within 2 hours of arrival in another time zone, and in some instances, the aviator has personally flown the aircraft to the deployed location.

Various attempts at therapeutic intervention for desynchrony have been made. The Argonne National Laboratory Diet (28 [appendix 1.3]) has been widely reported, but its efficacy has not yet been proven. More positively, temazepam at 30mg, had already been subject to extensive evaluation by the Royal Air Force before the Falkland Islands War. During that conflict, it was widely used with great success, and without dangerous side effects among aircrew, to induce sleep with which desynchrony would have interfered (33, 28). Preadaptation can be done by the individual if the schedule permits. One style of preadaptation is to gradually alter the person's sleep-wake pattern to match that of the destination (said to be the method of Wiley Post). The other is to go to the destination a few days early and adjust there without critical responsibilities (66, 57 [chap. 4]).

A different view point on circadian rhythm is found in the literature on sustained operations. Here, the concern is with the effectiveness of persons being awake (including work and meal time) for 20 hours, sleeping 3 or 4 hours and being awake another 20, perhaps for several days in a row. In this context, the length of a nap (not the 3-4 hour sleep) is generally more important than its temporal relation to circadian rhythm. However, when there is a heavy sleep debt, the nap should not be taken between 0400 and 0700 hours due to subsequent profound sleep inertia. People can get by with 3 or 4 hours of sleep per day and remain effective, but they cannot maintain their performance at the baseline level (51).

A study conducted by the USAF Armstrong Laboratory in 1993, examined B-1B (bomber) crews and their management of back-to-back, long-range missions. Simulator studies indicated that crews could handle two back-to-back 36-hour duty days with 36-48 hours between them with careful sleep and duty management. Three long missions could be tolerated if good sleeping facilities were available, ensuring rest between flights. This study uncovered several important factors that determine how long a rest period is needed between long sorties. These factors includes the duration of the mission, the amount of sleep obtained in the last 24 and 48 hours, and the amount of flight time logged in the previous 24 hours. To manage long-duration missions, these researchers recommended getting plenty of sleep two to three days prior to the mission, eating well, exercising, avoiding alcohol, planning a mission sleep schedule, and identifying mission segments when fatigue symptoms will be the worst. When crew members are tired they are advised to drink liquids, eat hot foods, move around, talk, and listen to music. The mission commander should tell each crew member when he or she is expected to sleep. The bottom line: Any sleep is good (59).

The costs of sleep deprivation should be known to the aviator and include, irritability, inattention, and loss of situational awareness. Most adults need 7.5 to 8 hours of restful (undisturbed) sleep. Rapid Eye Movement (REM) sleep is the most restful sleep despite its seemingly restless quality. The bulk of REM sleep occurs during the last third of the sleep period. Good sleep hygiene can maximize the beneficial effects of a short sleep time by decreasing the time it takes to fall asleep

and keeping awakenings to a minimum. Tips for good sleep hygiene include: daily exercise, keeping a moderate bedroom temperature, avoiding sleep preparations, eating a light snack at bedtime, avoiding excessive liquid consumption before retiring, avoiding caffeine, avoiding alcohol, not forcing sleep, using regular sleep times if possible, avoiding tobacco, not looking at the clock to calculate remaining hours for sleep, not napping if it prevents you from sleeping at night, and using your bed only for sleeping and sex.(49).

Section 8

Adjustment Disorders

Stress and fatigue can be the natural result of a Circadian Rhythm disturbance as well as numerous other stressors and can result in a dysomnia, or in an Adjustment Disorder. DSM IV (16) defines an Adjustment Disorder as the development of emotional or behavioral symptoms in response to an identifiable stressor occurring within three months of the stressor. The symptoms are either in excess of what would be expected from exposure to the stressor or there is significant impairment in functioning (16). Adjustment Disorders are fairly common diagnoses given to hospitalized aviators. They occurred in 15.4% of the cases of aviators admitted to psychiatric inpatient units during the period of 1986-1990 (20) and in 9% of aviators referred to ACS between 1980 and 1989.

Comprehension of stress and fatigue suffer from the outset with problems of definition. Among aviators, the problem is made more difficult by the use of denial. There is no measurable or specific definition of fatigue (15 [chap. 32], 33, 28) and some hold that any amount of stress is negative or destructive, whereas others find a moderate amount of stress necessary for optimal functioning (71). Insufficient amounts of stress can lead to boredom and low productivity, and excess stress to physical or emotional degradation (66). Against this caveat, we note that "stress" is a popular topic in current lay as well as professional media.

Fatigue is defined along different axes by different authors. Traditional considerations by aerospace medicine specialists have focused on acute skill fatigue, such as: decrements in psychomotor function, acceptance of lowered standards of performance, and narrowed attention span. This type of fatigue is often observed following one or more very demanding flights in a day, or even intense, uncomfortable mental activity such as taking a major examination. Acute fatigue is contrasted to cumulative fatigue where the aviator has not recovered from the first sortie before undertaking the second, then the third, etc., with ever increasing fatigue (66). In cumulative fatigue, the aviator's tolerance of stress is reduced on each subsequent flight. Acute fatigue can be overcome, at least briefly, by special effort or stimulation, for example during an in-flight emergency or combat. Acute fatigue is rather simply treated by a day's rest and adequate nutrition. Cumulative fatigue requires a longer period of rest.

More recent thinking proceeds along another axis categorized as external, environmental, or work-imposed stress versus self-imposed stress. Aviation-related stresses include: noise; combat; vibration; the effects of altitude, such as hypoxia and trapped gas; extreme temperatures; low-level flying with night vision devices (15 [chap. 32], 66); and low relative humidity (28). These illustrate rather than exhaust the list. These stresses may be modifiable to some degree by the flight surgeon (who can give current briefings on hypoxia, for example), the aviation life support shop (who can provide well-maintained oxygen masks), the aerospace psychologist (who can provide stress management and performance enhancement lectures and handouts), and the commander (who can keep the number of night or weather flights to the minimum required by the mission).

Contrasted to the stresses beyond the control of the individual pilot are those over which the flier has control. These are remembered by the mnemonic "DEATH:"

D - drugs, whether prescribed, over-the-counter, or illicit and includes side effects, such as caffeine-induced tremor

E - exhaustion from lack of sleep and physical exercise

A - alcohol and its depressant and judgment-altering effects

T - tobacco, which besides other deleterious health effects, produces 7-10% carboxy-hemoglobin, an equivalent to approximately 5,000 feet of altitude, and diminishes night vision

H - hypoglycemia can result from the tendency to eat irregular meals with high sugar snacks, sometimes causing insulin overshoot (66, 15 [chap 26])

In these areas, the flight surgeon may be of great assistance to the aviator in the squadron, whether seeing them individually, at the office, or in presentations at regular squadron meetings.

Since it is an inherent part of the typical aviator's personality to need to be in control, and in particular to avoid feelings, the anxiety induced by stress can be especially upsetting. Besides helping to change the lifestyle, the flight surgeon may specifically acquaint stressed aviators with "stress management" strategies. The goal is for aviators to learn one or more techniques to practice for anxiety relief. This process may be more formal when the flight surgeon instructs an aviator directly or refers the aviator to a base psychologist who is trained to perform classical Jacobsonian progressive relaxation, biofeedback or other methods. Alternatively, the process may be less formal by advising the aviator to try out one of the several inexpensive lay publications on relaxation.

Section 9

Personality Disorders

Personality Disorders are not medically disqualifying for flying duties; however, if social and occupational, administrative or legal ramifications are operant, a psychiatric or psychological evaluation may be warranted to clarify suitability for flying and continued military service. Thus a discussion of pilot personality follows.

Understanding the typical strengths and vulnerabilities of most pilots can be a useful tool in rendering services to this extremely stressed population. It is useful to understand the strengths and vulnerabilities of this group because when things go wrong, the consequences can be severe. Because aviators are unconnected to their emotional lives, they will have few or no mechanisms to deal with failure (65). They are then likely to self-medicate, argue with their spouse, or convert their emotional conflicts to physical complaints and present these symptoms to the flight surgeon. Failure to recognize the failing aviator can ultimately result in a mishap that may have been preventable.

Tom Wolfe, in The Right Stuff (70), describes the stereotype of the "right stuff" as an amalgam of stamina, guts, fast neural synapses, and old-fashioned hell raising. The popular media has saturated us with other books and movies that present profiles of pilots. Is there, however, just one type of pilot? Pilots are not clones of each other, and over-generalization and stereotyping can be very misleading, and resented by aviators. Similar to snowflakes, no two pilots will ever be exactly the same. Fighter, test, and light-attack pilots, along with astronauts, are the most frequently studied, at the expense of tanker/transport pilots, navigators, weapons officers, flight surgeons, and enlisted flying personnel. (19). Most times the information that applies to one group is extrapolated to the other groups regardless of the actual validity of doing so. Also, there are many different motivations for flying and motivation changes with age, crisis, loss, etc. So, attempting to understand the individual aviator requires avoiding preconceived notions or stereotyped, cookie-cutter caricatures.

Adequately cautioned, let us now look at the modal pilot (based on the observations of Dr. Frank Dully, retired Navy flight surgeon): The pilot is a controller who avoids what cannot be controlled at all costs. Situations are typically not entered into without there being a clear plan for egress or ejection. The concept of control is not limited to controlling an aircraft. Everything must be controlled including spouse, children, dog, car, and house. If the controller is not in control or can't at least pretend to be, he or she will be very irritable. Controllers hate surprises, so they practice, practice, and then practice some more. These individuals plan their spontaneity, so their emotions are handled similarly.

Aviators have difficulty with intimacy in their marriages because emotional distance from others is maintained at most times. Male pilots often list "communication" as deficient in their marriage

and in need of improvement or are completely unaware of any problems at all in their marriages and are taken by surprise when their wives leave (58). On psychological testing, this group will typically score high in gregariousness but low in warmth; they are extroverted introverts. Remember, this group is high-achieving and it's difficult to nurture friendships while studying or otherwise striving to achieve. This group typically majored in science or engineering rather than liberal arts in college. Pilots have the ability to separate flying and nonflying-related issues so that they may be dealt with at the appropriate times. Pilots are mission-oriented compartmentalizers. If an issue is not connected to the mission at hand, it is ignored. It is no surprise that these individuals are unconnected to their emotional lives. Pilots are systematic and methodical. They rely on checklists and feedback. Their goal is to avoid surprises, so they are likely to appear inflexible or even rigid.

The contradictions in the psychological make-up of an individual pilot can make any concept of the "pilot personality" appear less valid. They are highly intelligent, but are not intellectually oriented. The average pilot Intelligence Quotient is 125 (95th percentile of the general population) but they are not likely to hang out in libraries. They can be team players, but they are less comfortable in close relationships. They are likely to be gregarious and appear extroverted but, in reality, they are not particularly warm. They have many acquaintances but very few, if any, close friends. From a safety standpoint, they are very efficient. Safety is vulnerable to compromise, however, when something goes wrong in their ordinarily well-ordered lives, such as a child born with birth defects, death of a parent, marital problems, serious personal illness (whether or not a grounding condition), base closure, or loss of a flying job.

There is no one single pilot type. Recent attempts (26) have identified at least three broad categories of pilots based on the general concepts of competence (C) and sociability (S). The largest is the achievement-oriented, dominant, and affiliative type that takes a practical approach to problem solving.(C+S+) This subgroup tends to be level-headed and values officership and camaraderie. Another subgroup is similar to the first but tends to be more dominant, aggressive, exhibitionistic, and self-aggrandizing (C+S-). The third and final subgroup is cautious, compulsive, and socially retiring (C-, S-). This subgroup tends to be the least socially affiliative or achievement oriented. Research has demonstrated that membership in any of these groups does not strongly predict success or failure in military aviation (55), though the pilot who is both technically proficient and interpersonally adept has been found to perform the best in the cockpit (26).

Understanding the vulnerabilities of aviators can be a useful tool in rendering services to this population. Know the pressure points for this group and beware when they start to self-medicate, argue with their spouse, or present themselves to the flight surgeon with physical problems that do not appear to have an organic basis. Flying satisfies their need for achievement, individual initiative, novelty, excitement, and responsibility. We don't know if the characteristics peculiar to the pilot are formed by the task, or if the job attracts people with these traits, or if both factors are operative. The generalizations about pilots may also be true of other professions.

Other studies have looked at the so-called strengths of pilot personalities (18, 19, 53, 57). These characteristics include trait of confidence, patience, strong motivation to fly, maturity, achievement-oriented, responsible, direct, high intelligence, excellent physical health, good team players, desire for success, and other traits. On the whole, they are much more dominant and achieving than their nonflying counterparts. Mastery of complex skills is a primary issue with pilots (14 [chap. 17]). In addition to being competitive, dominant, and achieving, they must possess a fair degree of self-control and level-headedness in order to function within the highly structured military environment. Pilots are leaders and followers; that is, they function as part of a team and are expected to subordinate their own desires to complete the mission. Pilots tend to be seen as more exhibitionistic, more confident and self-possessed, and are more likely to seek thrills and risks. They pursue a dangerous and, in their own eyes, glamorous profession. While seen as conforming company individuals, pilots have a need for novelty and exciting stimulation.

The "normal" psychological pilot defenses are typically rationalization, intellectualization, and compartmentalization (19). With these three defenses and others, the pilot is able to handle the dangers of flying. While the first two are defense mechanisms seen in many individuals, the third is indicative of the aviator being a mission-oriented compartmentalizer (17). In the cockpit, the flier consciously uses compartmentalization as a system to exclude distractions while in control of an expensive and complicated airplane. Other compartments are excluded such as overdrawn bank accounts or a fight with the spouse.

When the pilot's coping mechanisms are overwhelmed, and they can no longer compartmentalize, deny or rationalize, the "failing aviator" syndrome may appear. The most common cause is a failing marriage. The spouse repeatedly faces stresses, burdens, and hardships not found in the families of individuals in other occupations, and many times faces them alone. Some marriages cannot survive. A pilot's behavior patterns may change and he or she may feel out of control. The stresses at home soon overwhelm the pilot's ability to successfully compartmentalize, and he or she ruminates. Red flags of the "failing aviator" syndrome include behaviors such as increased risk taking, alcohol excess, speeding, alcohol-related vehicle tickets, marital conflicts, and automobile accidents, which can be followed by an aircraft accident. Subtle changes often precede these more obvious incidents: such as procrastination, cynicism, tardiness, social withdrawal, or any behavior or attitude change that persists. The destructive direction of this behavior pattern can be reversed by a respected individual. The intervention of pointing out the destructive pattern the individual is using to cope with the stressful situation may not immediately solve the family problems, but may help. The ultimate goal is to keep an aviator healthy and productive (17).

Clinical duties of the flight surgeon require that the flight surgeon be able to assess the psychiatric status of patients, manage milder psychiatric cases, refer difficult psychiatric cases, and understand psychological factors operative in group dynamics. Because of the relationship the flight surgeon has with the squadron, he has numerous opportunities to observe and respond to psychological factors at work in the operational setting. Intervention in the clinical setting or

in the operational setting is one of the roles of the flight surgeon in dealing with psychiatric stress and disease.

A study looking at "Top Performers" in F-16 aircraft demonstrated that USAF pilots are notable for their lack of psychiatric illness and are intellectually very bright. It also found that aviators can agree who are the top performers in their squadron and what personal qualities are important in top performers (21). Another study demonstrated that psychological testing designed for clinical patients may overestimate the magnitude of personality pathology in pilots, even when they have been clinically referred (38).

Section 10

V Codes

V Codes are other conditions that may be a focus of clinical attention. One of these is Occupational Problem, used when the focus of clinical attention is an occupational problem that is not due to a mental disorder. An example of an occupational problem that may affect pilot trainees is airsickness.

Airsickness can be devastating to an aviator's career and to his self-esteem. The very new aviator may end up finished before he even really starts. The techniques to manage, or even prevent, airsickness, however, are simple. With a relatively small investment of time spent learning these techniques, you can help an aviator return to the sky.

The efficacy of treatment for airsickness has been shown in several programs (35). The Sheppard AFB airsickness prevention and management program historically had a high success rate. Of the student pilots airsick, well over 90+% were able to continue in pilot training (39). The program eventually changed its focus from treatment of airsickness to proactive measures to prevent airsickness. The causes of airsickness are multiple. Each individual case is likely to be a combination of several important factors. The first is adaptation. Acceleration, unfamiliar aircraft attitudes, and environmental stressors in the aviation environment present adaptational challenges. During undergraduate pilot training, lack of adaptation is the most common reason for difficulties with airsickness. Another common cause is Sympathetic Nervous System over-arousal. The body gears itself up to meet the challenges previously listed. A frequent problem is sympathetic overshoot resulting in rapid breathing, heart palpitations, sweating, etc. The next problem is conflicting information. The brain receives conflicting information from the visual and vestibular systems during motion stimulation. This mismatched information is interpreted by the brain in much the same way that cues about poisoned food are processed. The responses of general nausea and emesis are therefore not unreasonable. The next common cause is anxiety regarding performance. Aviators, similar to other high achievers, want to do very well. It is possible, however, to become over-motivated (71). The result, sadly, is a decrement in performance. Think

about studying unusually hard for an exam and "choking" while taking it. Another problem is called manifestations of apprehension. Airsickness is sometimes an indication that a person would rather not be flying and is in fact even afraid to fly. Rather than consciously experiencing the fear and recognizing their desire not to fly, a physical symptom is unconsciously manufactured that prevents flying. This cause, however is rare in student pilots and even more rare in rated aircrew members (known in this population as "Fear of Flying"). The last possible cause of airsickness is low motivation. Airsick aviators are sometimes poorly motivated. Some discomfort is inherent in the flying environment and even contributes to the fun of flying. When an individual consistently complains about the discomforts of flying, suspect poor motivation and consequent lack of tolerance to learning how to deal with the challenges of flight. Low motivation is much more common than manifestations of apprehension in the airsick student pilot population.

There are two types of airsickness and both result in a deviation in the mission profile. The first is active and is characterized by rapid heart rate, sweating, excessive salivation, cold hands and feet (literally) and nausea, finally culminating in emesis. The second is passive and includes all of the above symptoms except emesis. Nevertheless, a deviation in the mission profile occurs due to the nausea and/or discomfort.

Helping aviators avoid or manage airsickness consists of several phases. The first phase involves prevention and education and includes exposing all incoming students to prevention and management techniques, before they fly. The Anti-Airsickness Behavioral Checklist (see below) includes diaphragmatic breathing and sleep hygiene guidelines. Phase 2 is reassurance and re-education. If a student becomes actively or passively airsick and is referred to you, reassure him by normalizing the experience and personally giving him a copy of the behavioral checklist. Phase 3 includes relaxation and desensitization. If a student continues to experience airsickness, it is time to get a good look at what might be going on. This might also be a good time to make the referral to the local aerospace psychologist, if he or she is available. Plan on spending about 30 minutes with the airsick student and explore his motivation to fly, at what point in the flight he begins to feel sick, what his particular symptoms are, etc. It is useful to use a structured interview. If you determine that the student is motivated to fly and not suffering from manifestations of apprehension, this is a good time to get started on relaxation and desensitization exercises. A five tape series has been developed that takes the student through a flight in a coping fashion. Remember to reassure the student and normalize his experience. The fourth and final phase has been coined "BAM" (Behavioral Airsickness Management) at Sheppard AFB. It is an aggressive and formal intervention used when three active episodes of airsickness have occurred. It involves three consecutive days of spinning the aviator and coaching him how to recognize and deal with his "airsickness" symptoms early.

The Anti-Airsickness Behavioral Checklist begins with recommendations for pre-flight. Advise the students of the following and be sure to be very reassuring at all times. Have them start by practicing diaphragmatic breathing (see below) and eating before all flights. Caution against acidic foods, such as orange/tomato/grapefruit juice, caffeine, and greasy food. Have them drink

plenty of water to keep well hydrated and practice good "sleep hygiene"(see rules for good sleep hygiene under section on fatigue). Advocate the wearing of comfortable, loose clothing. Ensure they breathe during the flight, slightly slower than their instructor pilot (I.P.). Have them use diaphragmatic breathing at a slow, comfortable pace. Caution against head movements. If they need to make a clearing turn, advise they first move their eyes and then follow with their head. Have them practice this technique during driving and other ground activities. Advise them to keep two fingertips on the stick at all times when the I.P. has control of the aircraft, if possible. This technique allows them to feel in control and anticipate motion. If their feet get cold during flight, have them wiggle their toes to increase blood flow. If, despite your and their best efforts they still get sick, whether active or passive in nature, reassure them. Many students get sick when they are learning to fly and get over the problem with more flying. Airsickness is usually the result of stress and lack of adaptation. Airsickness is a training problem that many pilots before them have experienced and coped with successfully. Have students and other aviators use these techniques even if they are not prone to airsickness to enhance performance.

To practice diaphragmatic breathing, advise a comfortable posture with loosened clothing or flight suit. Have them place their hand lightly on their abdomen and inhale slowly through their nose, allowing the air to go all the way down to the abdomen. The abdomen should expand, causing their hand to move forward. (Sometimes it is helpful to have them practice in front of a mirror.). Advise them to hold their breath gently and momentarily. Exhale slowly (taking 2-4 times as long to exhale as to inhale), pushing the abdomen in with their hand. Repeat at a slow, comfortable pace. When flying with an I.P., advise them to listen to his or her breathing on the "hot mike" and breathe slightly slower than him or her. (This technique can actually keep them calmer than their I.P.). If they begin to feel dizzy, advise that they simply resume their normal pattern of breathing (they may not be used to getting that much oxygen.) This technique requires practice, practice, practice. Smokers may especially notice a difference in their experience of relaxation using this technique.

Another important occupational problem in the aviator population is Fear of Flying. It is a symptom which can afflict air passengers as well as aircrew. While it may be resolved readily by civilians simply by choosing not to fly, for military members (and aircrew in particular) it represents a major problem. Fear of flying may be one of several symptoms when a person suffers from a diagnosable mental disturbance. However, the usual use of the term "Fear of Flying" is restricted to a single symptom in an otherwise healthy person and is used in this context in the discussion below. It is commonly thought of as a "symptom without a disease" (33) and is frequently considered in relation to motivation to fly (14 [chap. 17], 31, 56).

Motivation to fly is derived from either of two roots. The emotional root is determined earlier in life, usually before the age of eight, and is expressed as, "I've always wanted to fly!" (33). It is related to the need for active mastery of the environment, and flying is perceived as an extraordinary opportunity to pursue this theme. The intellectual root is of later origin, as a late teen or even after entering the service, and is based on recognition of the career, prestige,

cognitive challenge or other opportunities opened to one by flying (14 [chap. 17]). In actual practice, there is often a mixture of the two. While either motivation may last a career or fail under the real dangers of flying (a personal close call or loss of a friend) or the process of maturation, earlier motivation is more durable overall. During undergraduate pilot training, the USAF considers conscious fear of flying, termed "manifestations of apprehension" (MOA), as grounds for nonpunitive, administrative, dismissal from flight training (14 [chap. 17]). MOA is, as described under the airsickness heading, presumed to be an unconscious fear evidenced by frequent sick call visits and psychophysiologic complaints. The Navy has similar views and procedures (67).

Procedures and dispositions differ after an aviator graduates from flight training and is considered rated. Again, the presentation may be conscious Fear of Flying and the person is referred to the flight surgeon and a mental health provider to determine whether it is a part of a mental illness (31). If so, the person is treated until recovered. If the person does not recover, disposition is through medical channels. However, if the person is found to be without any mental illness or recovers from the mental illness but still refuses to fly, then psychotherapy may be useful to relieve the fear. It is possible to form a therapeutic alliance with someone whose motivation is not altogether gone. In the past, therapy had little to offer aviators with a Fear of Flying (10), but since the development of behavioral approaches, results have been more gratifying (63, 4, 10, 31). Such therapy must be initiated promptly to avoid further fixation of the symptoms over time. This therapy exceeds the scope of the flight surgeon and is in the purview of the aviation-experienced psychiatrist or psychologist. The aviator who refuses therapy and the person who still declines to fly after therapy are subject to administrative disposition (no mental illness but unwilling to fly) which can range from nonpunitive re-classification to dismissal from the service (usually through a Flying Evaluation Board).

Other cases of Fear of Flying will present with psychophysiologic symptoms. The procedure here is to perform a thorough medical work up, determining that there is no detectable physical basis for the complaints. Attention is then given to the likelihood that they are due to psychological factors and are outside the consciousness of the aviator. Clues that the problem is psychogenic include the aviator's preoccupation that the symptom interferes with flying (often safety is seen as compromised somehow), preoccupation with the symptom and flying, lack of concern over an underlying disease process, and negative or reservedly positive reply to the question of whether the flier will fly again when the symptoms are resolved (14 [chap. 17], 31, 33). Here the symptoms help the aviator avoid flying, which is the feared activity; that is, the symptoms are ego-syntonic. As the fear is unconscious, the person typically declines any therapy. These cases may be very difficult, and whether to proceed with a medical disqualification for the symptoms or an administrative disposition for refusal to fly can be a vexing problem. As this can be a difficult dilemma, just as the one of being certain that there is no mental illness present in the case of conscious Fear of Flying, the aviator should have a consultation with an aviation experienced psychiatrist or psychologist for the greatest satisfaction of the aviator, the USAF, and the flight surgeon.

Strongin (61) provides an overview of the history and contemporary studies of Fear of Flying. He lists three important questions the flight surgeon should explore when faced with one of these cases:

- 1.) Whether the symptoms stem from a preexisting disorder
- 2.) Whether the person was overwhelmed by situational stress or overwork
- 3.) Whether changes in life circumstances have temporarily altered the flier's motivational or defensive structure.

The flight surgeon may then apply his or her clinical judgment to the problem of diagnosis and treatment.

In conclusion, the information and available research in the area of neuropsychiatry and aviation is comprehensive and widening. There are, however, many areas of study still waiting to be explored. These include the personality characteristics of female aviators, the impact of mixed-gender squadrons on performance and mission completion, the effects of aviation on women's health, and the characteristics of top performers. Another topic of interest is the ability of psychiatrists and psychologists to help "select-in" potential successful aviators rather than only helping to "select out" those with psychiatric illness. This attempt may become more important in the future as the armed forces draw down and cockpits become fewer and more versatile.

The interested reader is referred to other important references on these topics, (2,3,5,8,18,19,24,41,42,43,44,50, and 53).

References

1. AFI 48-123, Medical Examination and Standards. 1994.
2. AFR 50-5, US Air Force Formal Schools.
3. AFP 127-1, vol. 1, US Air Force Guide To Mishap Investigation.
4. Aitken JR and Benson JW. The use of relaxation/desensitization in treating anxiety associated with flying. *Aviat. Space Environ. Med.* 1984; 55:196-9.
5. Ashman A and Telfer R. Personality profiles of pilots. *Aviat. Space Environ. Med.* 1983; 54:940-3.
6. Bartone PT, Ursano RJ, Wright KM, et al. The impact of a military air disaster on the health of assistance workers. *J. Nerv. Ment. Dis.* 1989; 6: 317-28.
7. Bordelon VP and Kantor JE. Utilization of psychomotor screening for USAF pilot candidates: independent and integrated selection methodologies. Air Force Human Resources Laboratory-Technical Report-86-4, 1986.
8. Brain WR. *Diseases of the Nervous System*. Revised by Walton JN, 8th ed. New York: Oxford University Press, 1977.
9. Burkle FM, Sanner PH and Wolcott BW. *Disaster Medicine*. New Hyde Park, New York: Medical Examination Publishing Co., Inc., 1984.
10. Carr JE. Behavior therapy and the treatment of flight phobia. *Aviat. Space Environ. Med.* 1978; 49:1115-9.
11. Carretta TR. Basic attributes test (BAT) system: development of an automated test battery for pilot selection. Air Force Human Resources Laboratory-Technical Report 87-9, 1987.
12. Cornum R and Copeland P. *She Went to War*. Novato: Presidio Press, 1993.
13. Cunningham JE. *Unexpected Loss: Reactions and Recovery in Personal Disaster*. Glendale, CA: 1979.
14. DeHart RL. *Fundamentals of Aerospace Medicine*. Philadelphia: Lea and Febiger, 1985.
15. Dhenin G. *Aviation Medicine*. London: Tri-Med Books Ltd., 1978.

16. Diagnostic and Statistical Manual of Mental Disorders, 4th ed. (DSM-IV). Washington, DC: American Psychiatric Association, 1994.
17. Dully FE. The lifestyle keys to flight deck performance of the naval aviator. Society of Automotive Engineers Pamphlet 831529, 1983.
18. Farmer EW. Personality factors in aviation. *Int. J. of Aviat. Safety* 1984;175-9.
19. Fine PM and Hartman BO. Psychiatric strengths and weakness of typical Air Force pilots. USAF School of Aerospace Medicine Technical Report 68-121, 1968.
20. Flynn CF, McGlohn SE, Miles R. Occupational outcome in military aviators after psychiatric hospitalization. *Aviat. Space Environ. Med.* Jan1996; 8-13.
21. Flynn CF, Sipes WE, Grosenbach MJ, et al. Top performer survey: computerized psychological assessment in aircrew. *Aviat. Space Environ. Med.* 1994;65: A39-44.
22. Flynn CF, Sturges MS, Swarsen RJ, et al. Alcoholism and treatment in airline aviators: one company's results. *Aviat. Space Environ. Med.* 1993; 64: 314-8.
23. Folkard S and Monk TH. *Hours of Work*. New York: John Wiley & Sons, 1985.
24. Giles DA and Lochridge GK. Behavioral airsickness management program for student pilots. *Aviat. Space Environ. Med.* 1985; 56:991-4.
25. Glass AJ. Psychotherapy in the combat zone. *Am. J. Psychiat.* 1954; 110:725-31.
26. Gregorich S, Helmreich RL, and Wilhelm JA. Personality based clusters as predictors of aviator attitudes and performance. In RS Jensen (ed), *Proceedings of the Fifth Symposium on Aviation Psychology*. 1989; Columbus, Ohio State University: 697-702.
27. Hartsough DM and Myers DG. *Disaster work and mental health-prevention and control of stress among workers*. Rockville, Md. National Institute of Mental Health, 1985.
28. Hawkins FH. *Human Factors in Flight*. Aldershot: Gower Technical Press, 1987.
29. Henmon VAC. Air service tests of aptitude for flying. *Journ. App. Psychology*, 1919; 3(2): 103-9.
30. Hyman SE. *Manual of Psychiatric Emergencies*. Boston: Little, Brown and Co., 1988.
31. Jones DR. Flying and danger, joy and fear. *Aviat. Space Environ. Med.* 1986; 57:131-6.

32. Jones DR. The Macy reports: combat fatigue in World War II fliers. *Aviat. Space Environ. Med.* 1987; 58:807-11.
33. Jones DR. US Air Force combat psychiatry. USAF School of Aerospace Medicine Technical Report 85-83, 1985.
34. Jones FD. Experiences of a division psychiatrist in Vietnam. *Mil. Med.* 1967; 132:1003-8.
35. Jones DR, Levy RA, Gardner L, Patterson JC, et al. Self-control of physiological response to motion sickness: Using biofeedback to treat air sickness. *Aviat. Space and Environ. Med.* 1985; 56: 1152-7.
36. Kaplan HI, Freedman AM and Sadock BJ. *Comprehensive Textbook of Psychiatry III*. Baltimore: Williams and Wilkins, 1980.
37. Kaplan HI. and Sadock BJ. *Comprehensive Textbook of Psychiatry*, 4th ed. Baltimore: Williams and Wilkins, 1985.
38. King RE. Assessing aviators for personality pathology with the Millon Clinical Multiaxial Inventory (MCMI). *Aviat. Space Environ. Med.* 1994; Mar: 227-31.
39. King RE and Lochridge GK. Flight Psychology at Sheppard Air Force Base. *Aviat. Space Environ. Med.* 1991; Dec: 1185-8.
40. King RE and Flynn CF. Defining and measuring the "Right Stuff": Neuropsychiatrically Enhanced Flight Screening (N-EFS). *Aviat. Space Environ. Med.* 1995; 66: 951-6.
41. Krahenbuhl GS, Marett JR and Reid GB. Task-specific simulator pre-training and in-flight stress of student pilots. *Aviat. Space Environ. Med.* 1978; 49:1107-10.
42. Letters to the Editor (6 letters). *JAMA* 1988; 259:350-2.
43. Mauro CA and Smith DE. A statistical analysis of motion sickness incidence data. *Aviat. Space Environ. Med.* 1983; 54:253-7.
44. Markovits AS. Photo-refractive keratectomy (PRK): Threat or millennium for military pilots. *Aviat. Space Environ. Med.* 1993; 64:409-11.
45. McDuff DR and Johnson JL. Classification and characteristics of Army stress casualties during Operation Desert Storm. *Hosp. Community Psychiatry.* 1992; 43: 812-15.

46. McFarland RA. Influence of changing time zones on air crews and passengers. *Aerospace Med.* 1974; 45:648-58.
47. McKinnon RA and Michels R. *The Psychiatric Interview in Clinical Practice.* Philadelphia: W.B. Saunders Co., 1971.
48. Mills JG and Jones DR. The adaptability rating for military aeronautics: an historical perspective of a continuing problem. *Aviat. Space Environ. Med.* 1984; 55:558-62.
49. Morin CM. *Insomnia, Psychological Assessment and Management.* New York: Guilford Press, 1993.
50. Morris HH and Estes ML. Traveler's amnesia: transient global amnesia secondary to triazolam. *JAMA* 1987; 258:945-6.
51. Naitoh P, Englund CE and Ryman DH. Sustained operations: research results. Naval Health Research Center Report No. 87-17, 1987.
52. Nicholson AN and Stone BM. *Sleep and wakefulness handbook for flight medical officers.* AGARDograph No. 270(E), 2nd ed., 1987.
53. Novello JR and Youssef ZI. Psycho-social studies in general aviation: 1. Personality profile of male pilots. *Aerospace Med.* 1974; 45:185-8.
54. Patterson JC (ed). NATO-AGARD, Neurol., Psychiatric, Psychological aspects of Aerospace Med. 1991; N92-13547.
55. Picano JJ. Psychological factors influencing performance and aviation safety. JC Patterson (ed) NATO-AGARD, Neurol. Psychiatric, Psychol. aspects Aerospace Med. 1991; N92-13547: 4-51.
56. Pursch JA and Reinhardt RF. Psychophysiologic and conversion mechanisms: the aviator's emotional face curtain. *Aerospace Med.* 1971; 42:1015-7.
57. Randel HW. *Aerospace Medicine*, 2nd ed. Baltimore: The Williams and Wilkins Co., 1971.
58. Raschmann JK, Patterson JC, and Schofield G. A retrospective study of marital discord in pilots: The USAFSAM experience. *Aviat. Space and Environ. Med.* 1990; 61: 1145-8.
59. Scott WB. USAF research aids crew fatigue management. *Aviat. Week Space Tech.* 1994; Nov: 23.

60. Strange RE and Arthur RJ. Hospital ship psychiatry in a war zone. *Am. J. Psychiat.* 1967; 124:281-6.
61. Strongin TS. A historical review of the fear of flying among aircrewmembers. *Aviat. Space Environ. Med.* 1987; Mar: 263-7.
62. Talbott JA, Hales RE and Yudofsky S. Textbook of psychiatry. Washington, DC: American Psychiatric Press, 1988.
63. Turin SA. Systematic desensitization of a phobia for flying with the use of suggestion. *Aviat. Space Environ. Med.* 1977; 48: 370-2.
64. Ursano RJ. Military psychiatry: a tri-service perspective. USAF School of Aerospace Medicine Technical Report 86-35, 1987.
65. Ursano RJ. Stress and adaptation: The interaction of the pilot personality and disease. *Aviat. Space and Environ. Med.* 1980; 5: 1245-9.
66. US Army. Aeromedical training for flight personnel. FM1-301, May 1987.
67. US Navy. US Naval flight surgeon's manual, 2nd ed., Office of Naval Research. Washington, DC: US Government Printing Office, 1978.
68. Verdone RD, Sipes W, Miles R. Current trends in the usage of the Adaptability Rating for Military Aviation (ARMA) among USAF flight surgeons. *Aviat. Space Environ. Med.* 1993; 64: 1086-93.
69. War Department, Technical Manual 8-325. Washington, DC, Dec 1940.
70. Wolfe T. The Right Stuff. New York: Bantam Books, 1980.
71. Yerkes RM and Dodson JD. The relationship of strength of stimulus to rapidity of habit formation. *Journal of Comparative Neurology.* 1908: 18:459-82.